An overview of the Queensland macropod monitoring programme

G. Lundie-Jenkins,[1] D. W. Hoolihan[1] and G. W. Maag[2]
[1]Queensland Department of Environment and Heritage, 158 Hume Street, Toowoomba, Queensland 4350
[2]Queensland Department of Environment and Heritage, Hermitage Research Station, Warwick, Queensland 4370

ABSTRACT

Four species of macropods are commercially harvested in Queensland, red kangaroos, eastern grey kangaroos, common wallaroos and whiptail wallabies, under the control of the *Nature Conservation (Macropod Harvesting) Conservation Plan 1994*. Queensland's harvest represents the major portion of the national total, ranging from 55 to 68% for the period 1984 to 1992. Since the introduction of quotas in 1975, systems have been in place to monitor population trends, the size and distribution of both the commercial and non-commercial harvest, non-harvest mortality and reports of damage to primary production. These data provide the basis for monitoring both the population status of each of the commercial macropod species and any effects of harvesting. Direct monitoring in Queensland has involved aerial surveys, using both fixed-wing aircraft and helicopters, and ground surveys, both on foot and using vehicles. Indirect monitoring is achieved through the determination and analysis of harvest parameters including sex ratio, average carcass weights, skin sizes and total numbers harvested. This information is obtained from returns provided by shooters and dealers. Funding derived from a levy applied on the tags provided to shooters is used to develop and refine the techniques to monitor and manage macropod harvesting in Queensland.

INTRODUCTION

Until 1952 macropods were officially labelled as vermin in Queensland and there were no controls exercised over either the species or numbers of macropods harvested. Regulation of the industry came with enactment of the *Fauna Conservation Act 1954–1979* in 1954. While this legislation placed some restrictions on the species which could be harvested, no limits were placed on the sizes or numbers of macropods which could be harvested (Kirkpatrick and Amos 1985). It was not until 1970, when restrictions were introduced on the numbers and locations of chiller boxes, that there was any real attempt to provide some restriction on harvests (Anon. 1994). Quotas were introduced in 1975, along with numbered, self-locking, non-reusable tags which had to be attached to each animal entering the industry. Further control of macropod harvesting in Queensland occurred in 1992 with enactment of the *Nature Conservation Act 1992* and the subsequent development of the *Nature Conservation (Macropod Harvesting) Conservation Plan 1994*. The broad aims of the conservation plan are:

- To ensure the conservation of the four species subject to this programme by maintaining populations throughout their existing geographical ranges in the state, subject to fluctuations related to land management practices and climatic conditions at the limits of distribution.
- To manage the four species subject to this programme as an ecologically sustainable resource, providing that the conservation of the species and their habitats is not compromised.
- To reduce economic loss or damage to nature and the pastoral and agricultural industries that high density populations of these macropods can cause.

Currently, commercial harvesting is permitted in Queensland for four widespread and abundant species: red kangaroos *Macropus rufus*, eastern grey kangaroos *M. giganteus*, common wallaroo *M. robustus* and whiptail wallabies *M. parryi*. Several other species have been harvested commercially in the past and some (e.g., the red-necked wallaby, *M. rufogriseus*, and the black-striped wallaby *M. dorsalis*) are still culled under damage mitigation permits, but these species do not enter the commercial industry.

Queensland's macropod management programme is administered from Charleville in the state's central west. All licences, tags (approximately 2.2 million annually) and return books are issued from Charleville, and all returns of operations (approximately 20 000 shooter returns and 30 000 dealer returns each year) and movement notices are received by the Charleville office. In 1995, approximately 1 290 shooters and 197 dealer sites were licensed throughout Queensland.

In 1992, the commercial kangaroo industry was estimated to be worth $12.58 million (Sattler 1995). This is based on a total harvest of 1.6 million during that year of which 75% was used as skin only and 25% for pet food with a small tonnage of meat exported for human consumption. Queensland's harvest has represented a major portion of the national total, ranging from 55 to 68% for the period 1984 to 1992 (Pople and Grigg 1997). The Commonwealth Government approved quotas for the 1997 Queensland commercial macropod harvest were:

- 950 000 eastern grey kangaroos
- 600 000 red kangaroos
- 180 000 common wallaroos
- 25 000 whiptail wallabies

Since their introduction in Queensland in 1975, annual commercial quotas for macropod species have been set utilizing information on current population trends established from annual aerial surveys, together with information on previous harvests, climatic conditions, the non-commercial harvest, non-harvest mortality and reports of damage to primary production. These data also provide the basis for monitoring both the population status for each of the commercially-harvested macropod species and any effects of harvesting.

DIRECT MONITORING OF POPULATION TRENDS

Aerial surveys

The first broadscale aerial survey of commercially-harvested macropods in Queensland was conducted in 1980 by CSIRO (Caughley and Grigg 1982). However, regular surveys (conducted by CSIRO and what is now Environment Australia) did not commence until 1984. During 1984 and 1992, annual surveys using a fixed-wing aircraft were conducted over approximately 500 000 km^2 of the pastoral zone. Since 1991, surveys have been conducted by helicopters in an attempt to provide more accurate and precise population estimates (Clancy *et al.* 1997) and, since 1993, it has been the only aerial survey method used on a broad-scale in Queensland. This method, developed by the Queensland Department of Environment and Heritage (QDEH), employs line transect methodology (Buckland *et al.* 1993) which is significantly more robust to variations in sightability than standard fixed-wing methods (Clancy 1999). The survey method employed in these surveys has been described by Clancy *et al.* (1997).

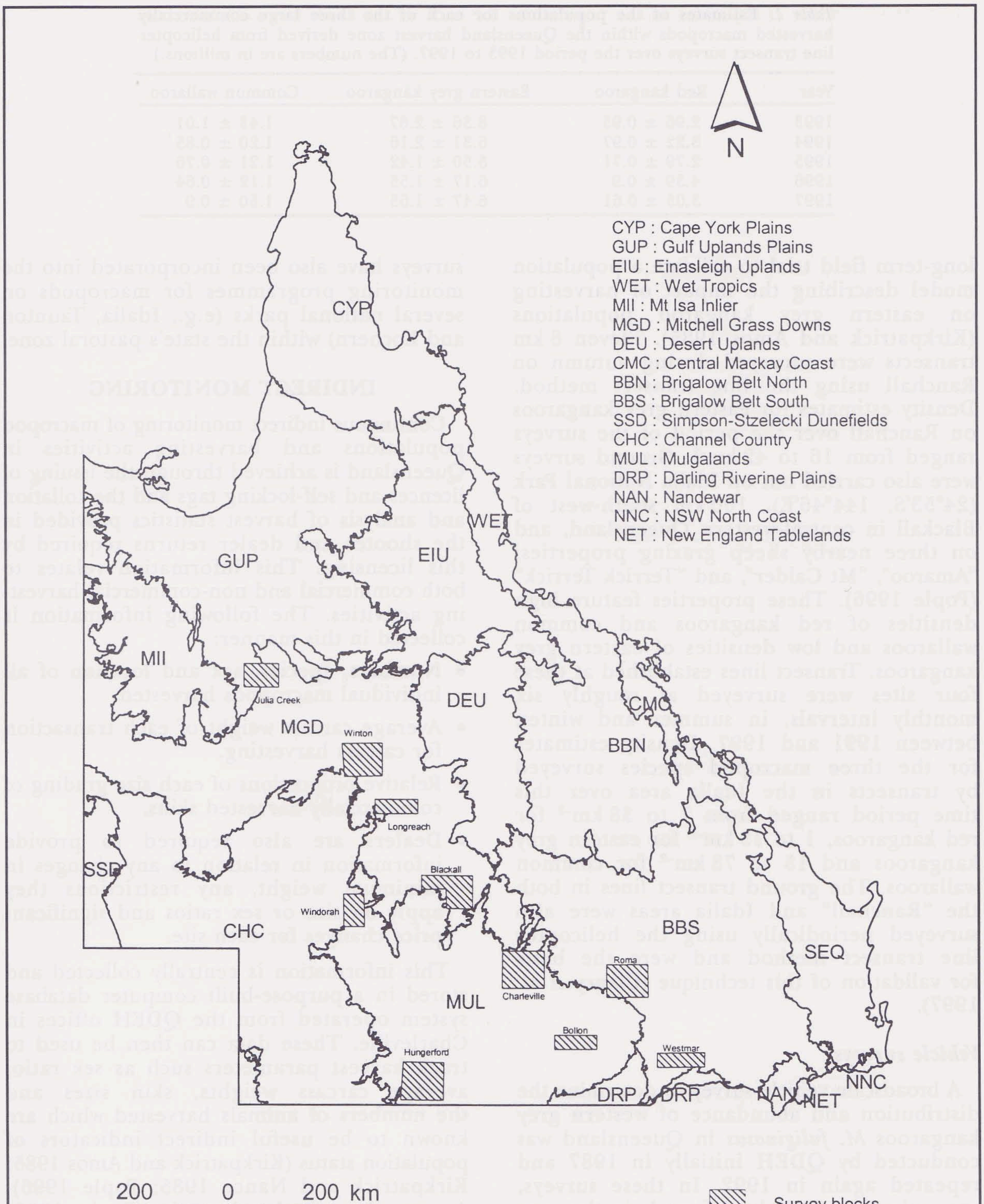
As a consequence of the greater operating costs of helicopters compared with fixed-wing aircraft, surveys are conducted in 10 monitor blocks, covering an area of 49 600 km^2 (Fig. 1) or 9% of the original fixed-wing survey area. In each survey block, four to eight 50–90 km transect lines have been placed systematically 10 km apart. Sampling intensity within each block is approximately 2.5%. Survey blocks were selected to represent the densities of macropods over a core harvest area of 630 000 km^2 (Pople *et al.* 1998). Population estimates are calculated by extrapolating mean block densities to a larger harvest area of 795 000 km^2 for eastern grey kangaroos, 890 000 km^2 for red kangaroos and 695 000 km^2 for common wallaroos. All blocks are surveyed annually between May and July and one block, centred on Blackall, is also sampled in December. The Blackall block represents a high harvest area for all three species and contains high densities of common wallaroo. Biannual surveys at Blackall provide greater precision for trend monitoring, assessment of indirect monitoring techniques and development of population models.

Estimates of the harvested populations for each species during 1991 and 1995 derived from this method comprised 2.8–3.2 million red kangaroos, 5.5–10.9 million eastern grey kangaroos and 1.2–2.1 million common wallaroos (Table 1). As the principal aim of the management programme is conservation of the species, these estimates (particularly for wallaroos) are conservative. Quotas are currently set at 20% of the red kangaroo population estimate and 15% of the eastern grey kangaroo and common wallaroo population estimates.

In addition to the use of conventional platforms for aerial surveys of macropod populations, QDEH provided funding for an investigation into the use of an ultralight aircraft. This study, conducted by the University of Queensland in at two sites in central-western Queensland, is reported in Grigg *et al.* (1997).

Ground surveys

The rugged terrain and forest cover that constitutes the habitat of the whiptail wallaby in Queensland precludes the use of aerial survey. Ground surveys were commissioned by QDEH during 1987 and 1988 (Southwell *et al.* 1995) and provided an estimate of 695 800 whiptail wallabies in the harvest area in Queensland. The surveys, covering an area of 160 000 km^2 of south-east Queensland, employed line transect counts involving two observers walking compass bearings and recording angles and distances to all animals sighted. On the basis of the small and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CYP : Cape York Plains
GUP : Gulf Uplands Plains
EIU : Einasleigh Uplands
WET : Wet Tropics
MII : Mt Isa Inlier
MGD : Mitchell Grass Downs
DEU : Desert Uplands
CMC : Central Mackay Coast
BBN : Brigalow Belt North
BBS : Brigalow Belt South
SSD : Simpson-Stzelecki Dunefields
CHC : Channel Country
MUL : Mulgalands
DRP : Darling Riverine Plains
NAN : Nandewar
NNC : NSW North Coast
NET : New England Tablelands
CYP
WET
GUP
EIU
MII
Julia Creek
DEU
CMC
MGD
Winton
BBN
Longreach
SSD
Blackall
Windorah
CHC
BBS
SEQ
Roma
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Survey blocks

Figure 1. Placement of helicopter line-transect survey blocks in relation to the biogeographic regions in Queensland.

declining commercial harvest of this species during the past five years, approximately 0.5–1% of the estimated population, no regular direct monitoring has been conducted. Annual quotas for the past 5 years have been set at 3% of the 1987/88 population estimate.

Prior to 1997, ground counts of commercial macropods were also carried out regularly in two areas in Queensland. Between 1987 and 1997, annual ground surveys were conducted on "Ranchall" (28°02'S, 149°37'E), near Westmar in southern Queensland, as part of

Table 1. Estimates of the populations for each of the three large commercially harvested macropods within the Queensland harvest zone derived from helicopter line transect surveys over the period 1993 to 1997. (The numbers are in millions.)

Year	Red kangaroo	Eastern grey kangaroo	Common wallaroo
1993	2.96 ± 0.95	8.36 ± 2.67	1.43 ± 1.01
1994	3.22 ± 0.97	6.31 ± 2.16	1.20 ± 0.85
1995	2.79 ± 0.71	5.50 ± 1.42	1.21 ± 0.76
1996	4.39 ± 0.9	6.17 ± 1.55	1.12 ± 0.64
1997	3.05 ± 0.61	6.47 ± 1.65	1.50 ± 0.9

long-term field trial to validate a population model describing the impact of harvesting on eastern grey kangaroo populations (Kirkpatrick and Amos 1985). Eleven 8 km transects were surveyed during autumn on Ranchall using the line transect method. Density estimates for eastern grey kangaroos on Ranchall over the period of the surveys ranged from 16 to 42 km^{-2}. Ground surveys were also carried out on Idalia National Park (24°53'S, 144°46'E), 100 km south-west of Blackall in central-western Queensland, and on three nearby sheep grazing properties: "Amaroo", "Mt Calder", and "Terrick Terrick" (Pople 1996). These properties feature high densities of red kangaroos and common wallaroos and low densities of eastern grey kangaroos. Transect lines established at these four sites were surveyed at roughly six monthly intervals, in summer and winter, between 1991 and 1997. Density estimates for the three macropod species surveyed by transects in the Idalia area over this time period ranged from 7 to 38 km^{-2} for red kangaroos, 1 to 13 km^{-2} for eastern grey kangaroos and 15 to 78 km^{-2} for common wallaroos. The ground transect lines in both the "Ranchall" and Idalia areas were also surveyed periodically using the helicopter line transect method and were the basis for validation of this technique (Clancy *et al.* 1997).

Vehicle surveys

A broadscale vehicle survey to determine the distribution and abundance of western grey kangaroos *M. fuliginosus* in Queensland was conducted by QDEH initially in 1987 and repeated again in 1992. In these surveys, approximately 3 000 km of roads in the grey kangaroo overlap region in the south-west of the state (Caughley *et al.* 1984) were surveyed to determine the relative densities of western grey kangaroos, eastern grey kangaroos and red kangaroos. Some preliminary comparisons were made between the results of these vehicle surveys and results from adjacent helicopter line transect survey blocks to evaluate the accuracy of vehicle counts for estimating relative and absolute abundance of macropods. Vehicle-based surveys have also been incorporated into the monitoring programmes for macropods on several national parks (e.g., Idalia, Taunton and Lochern) within the state's pastoral zone.

INDIRECT MONITORING

Continuous indirect monitoring of macropod populations and harvesting activities in Queensland is achieved through the issuing of licences and self-locking tags and the collation and analysis of harvest statistics provided in the shooter and dealer returns required by this licensing. This information relates to both commercial and non-commercial harvesting activities. The following information is collected in this manner:

- Numbers, species, sex and location of all individual macropods harvested.
- Average carcass weight of each transaction for carcass harvesting.
- Relative proportions of each size grading of commercially harvested skins.
- Dealers are also required to provide information in relation to any changes in minimum weight, any restrictions they apply on size or sex ratios and significant price changes for each site.

This information is centrally collected and stored in a purpose-built computer database system operated from the QDEH offices in Charleville. These data can then be used to track harvest parameters such as sex ratio, average carcass weights, skin sizes and the numbers of animals harvested which are known to be useful indirect indicators of population status (Kirkpatrick and Amos 1985; Kirkpatrick and Nance 1985; Pople 1996). A recently completed study (Pople 1996) included a detailed investigation of the relationships between these parameters and rates of harvest for red kangaroos. The development of indirect monitoring techniques is at an early stage. Research programmes, including work at "Ranchall" described previously, and an extension of the studies conducted by Pople (1996) on red kangaroos, will lead to substantial refinement of this method of monitoring. The current redesign of the computer database system used to collate and store these data will also facilitate the use of this information to enable real-time monitoring of harvested macropod populations.

The other indirect index of macropod populations collected in Queensland relates directly to the stated aim of the conservation plan to reduce economic loss or damage to natural vegetation and the pastoral and agricultural industries that high density populations of these macropods can cause. The non-commercial harvest of macropods is regulated by QDEH through the issuing of damage mitigation permits. The returns from these permits serve to identify areas within the state where landholders perceive that macropod densities are sufficiently high as to pose some threat to agricultural industries. Within Queensland, the annual non-commercial harvest, as indicated by the returns from damage mitigation permits over the past 10 years, has represented less than 5% of the approved quotas for each of the four commercial species.

FUTURE DIRECTIONS AND RESEARCH

While the current approach to monitoring is generally considered adequate in relation to the stated aims of the management programme, there is increasing pressure from various interest groups to either increase quotas or justify how the current quotas are set. The impetus for this pressure includes a rise in the value of kangaroos, an increase in industry demands and concern over the contribution of macropod populations to land degradation (Pople and Grigg 1998). Added to this are the contrasting concerns of sections of the animal welfare lobby that harvesting may be threatening the viability of macropod populations. While the interests of these groups are quite different, it is apparent that, whether the prime goal of management is conservation, sustained-yield harvesting or pest control, management decisions must be guided by the best available monitoring techniques. It is equally important that the results of such monitoring can be, as far as possible, interpreted in an unambiguous manner. Clearly ongoing refinement of monitoring techniques (direct and indirect) and further research into the impact of harvesting on kangaroo populations are needed. Within Queensland, funds derived from a levy applied on the tags provided to shooters are being directed to projects to address these issues including specific projects involving:

- Comparison of helicopter and fixed-wing survey techniques in Mitchell grass downs biogeographic region.
- Validation of indirect monitoring techniques for both eastern grey and red kangaroos.
- Redesign of the existing harvest database system to improve its capacity to interrogate and analyse harvest data.
- Investigation of management, ecological and social implications of regionalization of management of the quota.

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